

METHODS AND APPARATUS FOR DETERMINING CARDIAC OUTPUT

Abstract

[0070] The present invention provides methods and apparatus for determining a
5 dynamical property of the systemic or pulmonary arterial tree using long time scale
information, i.e., information obtained from measurements over time scales greater than a
single cardiac cycle. In one aspect, the invention provides a method and apparatus for
monitoring cardiac output (CO) from a single blood pressure signal measurement obtained
at any site in the systemic or pulmonary arterial tree or from any related measurement
10 including, for example, fingertip photoplethysmography.

[0071] According to the method the time constant of the arterial tree, defined to be the
product of the total peripheral resistance (TPR) and the nearly constant arterial compliance,
is determined by analyzing the long time scale variations (greater than a single cardiac
cycle) in any of these blood pressure signals. Then, according to Ohm's law, a value
15 proportional to CO may be determined from the ratio of the blood pressure signal to the
estimated time constant. The proportional CO values derived from this method may be
calibrated to absolute CO, if desired, with a single, absolute measure of CO (e.g.,
thermodilution). The present invention may be applied to invasive radial arterial blood
pressure or pulmonary arterial blood pressure signals which are routinely measured in
20 intensive care units and surgical suites or to noninvasively measured peripheral arterial
blood pressure signals or related noninvasively measured signals in order to facilitate the
clinical monitoring of CO as well as TPR.

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